

TO: AMWG/TWG
GCMRC.Scientists

FROM: Science Advisors: Lance Gunderson, Randy Parker, Virginia Dale, Jill Baron, John Loomis, Jim Kitchell, Doug Schwartz, Joe Watkins, David Hulse, Dale Robertson, and LD. & PJ. Garrett, M3 Research

DATE: August 29, 2001

SUBJECT: Input on Goals/Management Objectives/Information Needs

The Science Advisors met on July 31, 2001 to discuss the AMP Goals, Management Objectives and Information Needs. This has been followed by phone and e-mail interaction on various objectives and information needs. Input from Dr. Garrett regarding the TWG meeting of August 8 and 9 is also included.

We appreciate input from program managers Lambert, Liszewski, Melis and Ralston. Their technical knowledge was helpful in our evaluations.

We have chosen to provide both general comments and specific comments on the review of goals, management objectives and information needs. We hope the information provided is helpful in your efforts at program revisions.

In Subpart A, we have provided general comments on various aspects of the Adaptive Management Program, including structure, process, major program elements, etc. In Subpart B we have provided general input on management objectives. Some of these comments are reflected in reviews of information needs. In Subpart C we have attempted to evaluate the information needs, using three specific questions provided by Dr. Gold.

SUBPART A

GCMRC SCIENCE ADVISOR GENERAL PROGRAM COMMENTS ON THE AMP PROGRAM

The advisors have been requested in FY2001 and FY2002 to review objectives and information needs, science protocols, research procedures, competitive science process, Strategic Plan, Annual Science Plan, etc.

To date, with limited review, the advisors would like to make the following comments regarding program general development, structure, process, and elements. In major part the comments are directed toward specification of management objectives and information needs..

- A. GOALS/OBJECTIVES/INFORMATION NEEDS: Input provided in Subpart B and Subpart C..
- B. STAKEHOLDER ISSUES:
1. Do MOs and INs reflect, in some balance, all concerned and interested stakeholders?
 2. Are stakeholders limiting the Adaptive management process or complete stakeholder representation?
 3. If not, how can MOs and INs best represent all stakeholders?
- B. ISSUES OF INTEGRATION AND SYSTEMS APPROACHES:
1. Are concerns of NRC expressed directly in MOs or INs?
 2. Integration of approaches across resources as a system is not clear.
 3. Integration of science procedures; i.e. linked systems studies not specified strongly. Are science and data programs systems based, i.e. was a designed system approach used?
 4. Integration of field data collection (i.e. time and space dependance) not clearly specified.
 5. Systems model is viewed as excellent effort, but not specified in INs. How does it deal with exogenous elements?
 - Is it designed to evaluate integration of science and management?
 - Is it designed to assist managers and scientists in developing more integrated science?
 6. Does incomplete knowledge of resource resilience limit scientific process?
- A. ISSUES OF ADAPTIVE MANAGEMENT:
1. Where and how has learning occurred, and has this new knowledge emerged unconstrained in new management guidelines, establishment of new science and monitoring programs, and elimination of science or management programs?
 2. How is individual stakeholder trust and flexibility reflected in INs?
- E. COMMUNICATION:
1. Is communication of accomplishment beyond the AMP and science community

important? If so, where is it reflected in the MOs and INs?

2. Are information and education programs to fisherman, boaters, hikers, sightseers, etc. important? If so, how are they reflected in the INs? Are they part of a communication plan?

SUBPART B

COMMENTS ON GOALS AND MOs

GOAL 1: PROTECT OR IMPROVE AQUATIC FOODBASE.

RIN 1.1 - 1.2: Very comprehensive questions; do we know enough to refine? 1.3 0 1.7: Are these research or technical questions?

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|-------------------|------------------|---|--|
| MO 1.1 | | Y; But, if caloric requirements & fish population not known, then how do you know target? | N; How much do you maintain? Is a range known? |
| MO 1.2-1.5 | | Y; But same question as MO 1.1 | N; What level? |

GOAL 2: MAINTAIN OR ATTAIN VIABLE POPULATIONS OF EXISTING NATIVE FISH

IN 2.1-2.5: Technical questions.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|--|
| RIN 2.1 | Y | Y | N; "Is this a science question?" |
| MO 2.1 | | Y | Y; Assuming target levels are known and size threshold is correct. Are "other aggregations" necessary? If so, put in IN. |
| MO 2.2 | | Y | Y; Assuming "Viable population" and target levels reflect appropriate knowledge. |
| MO 2.5 | | Y | Y; Assumes appropriate knowledge. |
| MO 2.4 | | Y | N; If RIN 2.4.5 is not known, questions arise. |
| MO 2.5 | | Y | Y; But what of RIN 2.4.5? |
| MO 2.6 | | Y | Y; If accurate survival knowledge exists. |
| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |

| | | |
|---------------|---|---|
| MO 2.7 | Y; If "abundance" reflects removal of jeopardy. | Y; If "abundance" will remove jeopardy. |
|---------------|---|---|

| | | |
|---------------|---|---|
| MO 2.8 | Y | Y |
|---------------|---|---|

Observations: Many RINs seem overly comprehensive. Almost as though little is known of critical survival parameters, viable populations, caloric requirements, etc. Has a status of knowledge assessment be completed?

GOAL 3: RESTORE EXTIRPATED SPECIES.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|---|---|
| MO 3.1 | | N; This goal is in clear conflict with Goal 2 at this time. | Y; But inappropriate. Confounds both science and Adaptive Management? |

GOAL 4: MAINTAIN RBT WILD, REPRODUCING POPULATION IN LEES FERRY REACH.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|--------------------------|
| MO 4.1 | | Y | Y |
| MO 4.2 | | Y | Y |

Observation: Seems to be reasonable structured approach.

GOAL 5: MAINTAIN VIABLE KA POPULATIONS.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|--------------------------|
| MO 5.1 | | Y | Y |
| MO 5.2 | | Y | Y |

Observations: A reasonable structured approach, however, needs seem comprehensive. Did Status of Knowledge Review specify these extensive research needs?

GOAL 6: PROTECT & IMPROVE BIOTIC RIPARIAN AND SPRING COMMUNITIES.

How does Goal, MOs and INs relate to AMP as defined in law? I.e. non CR riparian zones.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|--------|------------------|-------------------------|--|
| MO 6.1 | | Y | Y; Are these CR flow related marsh habitats? |
| MO 6.2 | | Y | Y |
| MO 6.3 | | Y | Y |
| MO 6.4 | | Y | Y |
| MO 6.5 | | Y | Y |
| MO 6.6 | | Y | Y; How do non-CR related zones relate to AMP charge? |
| MO 6.7 | | Y | N; Are 6.5 and 6.7 incongruent? |

Observations: Appears to be extensive integration among aquatic and riparian habitats, food sources, and aquatic life, but the need to understand the integration is not highlighted in MOs.

GOAL 7: ESTABLISH WATER TEMPERATURE, QUALITY AND FLOW TO ACHIEVE ECOSYSTEM GOALS.

RIN 1.1-1.2: Very comprehensive questions; do we know enough to refine? 1.3-1.7: Are these research or technical questions?

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|------------|------------------|-------------------------|--|
| MO 7.1 | | Y | Y; INs seem to reflect minimal information needs. |
| MO 1.2-1.5 | | Y | Y; But are more INs to determine effect on biology needed? |

Observations: MOs to address impacts of water quality on biology of system seem missing. Are they known?

GOAL 8: MAINTAIN OR ATTAIN SEDIMENT STORAGE TO MEET ECOSYSTEM GOALS.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|--------|------------------|-------------------------|--------------------------|
| MO 8.1 | | Y | Y |
| MO 8.2 | | Y | Y |
| MO 8.3 | | Y | Y |
| MO 8.4 | | Y | Y |

Observation: MOs and INs seem explicitly structured to refine or add specific information. Apparent explicit ties to Goals and Mission. SInS are examples of specific integrated knowledge needed to understand resource interdependence and linkage. If resource element disaggregation is necessary, this section affords approach to integration.

GOAL 9: MAINTAIN OR IMPROVE RECREATION EXPERIENCE WITHIN ECOSYSTEM GOALS.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|--------|------------------|--|--|
| MO 9.1 | | N; Is safety a limiting factor on recreation experience? | N; Possibly displace by using only MO 9.2. |
| MO 9.2 | | Y; seems to be more appropriate INs. | Y |
| MO 9.3 | | Y | Y |
| MO 9.4 | | N; Suggest moving under 9.2. | N |
| MO 9.5 | | Y | Y |

Observation: Could information and education programs enhance recreation experience? The safety MOs best fit under 9.2.

GOAL 10: MAINTAIN OR INCREASE POWER CAPACITY AND ENERGY PRODUCTION WITHIN ECOSYSTEM GOALS.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------|------------------|-------------------------|---|
| MO 10.1 | | Y | Y; Are the RINs better approached through monitoring? |
| MO 10.2 | | Y | Y |
| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
| MO 10.3 | | Y | Y |

MO 10.4

Y

Y

Observation: Are tradeoff analysis (physical/economic) needs satisfied to demonstrate the social cost of experiments and possible new management direction.

GOAL 11: PRESERVE, PROTECT, MANAGE CULTURAL RESOURCES FOR FUTURE GENERATIONS.

| In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|------------------|-------------------------|--------------------------|
| | Y | Y |
| | Y | Y |
| | Y | Y |

Observation: Ins focus on relationship of resources to dam operations, whereas most MOs and INs for other goals do not. Is it necessary, and only implicit for other goals?

GOAL 12: MAINTAIN HIGH QUALITY PROGRAMS.

IN 12.2 it only seems to be addressing education program. Greater emphasis seems appropriate.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------|------------------|--|--------------------------|
| MO 12.1 | | N; Not clear how it supports goal. | N; Intent not clear. |
| MO 12.2 | | Y; Would seem to enrich science program. | Y |
| MO 12.3 | | N; Not clear how it supports goal. | N; Intent not clear. |
| MO 12.4 | | Y | Y |
| MO 12.5 | | N | N |

Observation: These MOs are more appropriately placed under goals on cultural resources and physical resources. The MOs seem to be after thoughts. The goal is appropriate, but should focus on adaptive management, program integration, systems approaches, communication, etc.

SUBPART C

SCIENCE ADVISOR REVIEW OF OBJECTIVES
AND INFORMATION NEEDS

The Science Advisors have reviewed the Information Needs developed in response to stakeholders Goals and Objectives. The review is developed around three questions presented to the Advisors by Dr. Gold. The questions, presented in brief are as follows.

1. Do the Information Needs satisfy the Management Objectives
2. Do the Information Needs and Management Objectives satisfy the Goals?
3. Are the Information Needs properly specified?

Significant effort is occurring by the TWG in revision of the INs. Hopefully this input will prove supportive of that effort.

GOAL 1: PROTECT OR IMPROVE AQUATIC FOODBASE.

| | IN Satisfies MO? | IN + MO Satisfies Goal? | Appropriately Specified? |
|---------|------------------|--|--|
| RIN 1.1 | | Y; But should be focused on Native fish in river. Is most of the answer known? | N; Should specify coloric needs of Native fish in river. |
| RIN 1.2 | | Y; But do we not have a lot of this information. | Y; But, don't we know much of this need? |
| RIN 1.3 | | Y; But not research. | N; Technical question of sampling/monitoring. Not research. |
| RIN 1.4 | | Y; Technical Need. | N; Not research. It is a technical question. It is important but should be in section on Technical Requirements. |
| RIN 1.5 | | Y; Technical Need. | N; See 1.4, 1.3. |
| RIN 1.6 | | Y | N; Technical question see 1.3-1.5. |
| RIN 1.7 | | Y | N; Technical question. |

RIN 1.3-1.7 are Technical questions that should be addressed through assessment of data gathering and assessment technology.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|--|------------------|-------------------------|--------------------------|
|--|------------------|-------------------------|--------------------------|

| MO 1.1 | | | | |
|---------------|----|--|----|---|
| CMIN 1.1.1 | Y | | Y | Y; Technical question |
| RIN 1.1.1 | Y | | Y | N; Should focus the question on most critical elements. |
| RIN 1.1.2 | NK | | NK | N; Question too general |
| RIN 1.1.3 | Y | | Y | N; Should be specified for most critical periods of life cycle previously determined. |

General Comment: It seems that IN RIN 1.1.1-1.1.3 could be much more specific. Much is known on each need to permit a more focused approach.

| | IN Satisfies MO? | | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|--|-------------------------|---|
| MO 1.2 | | | | |
| CMIN 1.2.1 | Y | | Y | N; Technical question. But, where below the Paria? |
| MO 1.3 | | | | |
| CMIN 1.3.1 | Y | | Y | N; Technical question. This is a large area and must vary significantly. |
| RIN 1.3.1 | Y | | Y | N; Area is large. Are some areas more important? |
| MO 1.4 | | | | |
| CMIN 1.4.1 | Y | | Y | N; Technical can this be focused, or is variance over reaches part of the need? |
| MO 1.5 | | | | |
| CMIN 1.5.1 | Y | | Y | N; If 1.5.1 is not known, how can this be addressed? |
| RIN 1.5.1 | Y | | Y | N; This research appears necessary before CMIN 1.5.1 is approached. |

General Comment: Was status of knowledge, problem analysis, etc accomplished? Some INs appear to seek extensive information, some of which scarcely exists. All Ins seem to be necessary to MOs and Goals, but more focus seems necessary.

GOAL 2: MAINTAIN OR ATTAIN VIABLE POPULATIONS OF EXISTING NATIVE FISH.

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|--|
| IN 2.1 - 2.5 | Y | Y | Y; Critical Technical question. Should be placed in system concept |
| RIN 2.1 | Y | Y | Y; Critical need for science design to capture habitat capability of CR for Native T&E Fishes. |
| MO 2.1 | | | |
| CMIN 2.1.1 | Y | Y | Y |
| MO 2.2 | | | |
| CMIN 2.2.1 | Y | Y | N; If you can only monitor in the LCR then specify only the LCR. |
| RIN 2.2.1 | Y | Y | Y |
| RIN 2.2.2 | Y | Y | Y; But, doesn't sufficient knowledge exist to answer this question. |
| MO 2.3 | | | |
| CMIN 2.3.1 | Y | Y | Y |
| MO 2.4 | | | |
| RIN 2.4.1 | Y | Y | Y |
| RIN 2.4.2 | Y | Y | Y; with current knowledge, can this be answered? |
| RIN 2.4.3 | Y | Y | Y |
| RIN 2.4.4 | Y | Y | N; Specify target temperatures and flows. |

| | In Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|-------------------------------|
| RIN RIN 2.4.5 | Y | Y | N; Is not part of this known? |
| MO 2.5 | | | |
| CMIN 2.5.1 | Y | Y | Y |

| | | | |
|---------------|---|---|--|
| RIN 2.5.1 | Y | Y | N; Tolerance limits given with other population parameter? |
| RIN 2.5.2 | Y | Y | N; Warning to what level? Specify level? |
| MO 2.6 | | | |
| CMIN 2.6.1 | Y | Y | Y |
| RIN 2.6.1 | Y | Y | Y |
| Rin 2.6.2 | Y | Y | Y |
| MO 2.7 | | | |
| RIN 2.7.1 | Y | Y | Y |
| MO 2.8 | | | |
| CMIN 2.8.1 | Y | Y | Y |
| RIN 2.8.1 | Y | Y | Y |
| RIN 2.8.2 | Y | Y | N; Should specify both the parameter and value of parameter? |
| RIN 2.8.3 | Y | Y | Y; But, could the question be more narrow based on existing knowledge? |
| RIN 2.8.4 | Y | Y | Y |
| RIN 2.8.5 | Y | Y | Y; This is needed but is not at least part of it known? |
| RIN 2.8.6 | Y | Y | Y |
| RIN 2.8.7 | Y | Y | N; Be more specific. Some of this is known. |
| RIN 2.8.8 | Y | Y | Y |

GOAL 3: RESTORE POPULATIONS OF EXTIRPATED SPECIES.

Since no IN exists it appears that the goal and objective are premature and may in fact be in direct conflict with other Goals.

GOAL 4: MAINTAIN REPRODUCING RBT POPULATIONS ABOVE PARIA AS POSSIBLE GIVEN NATIVE FISH GOALS.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|--|
| MO 3.1 | | | |
| CMIN 4.1.1 | Y | Y | Y |
| CMIN 4.1.2 | Y | Y | Y |
| RIN 4.1.1 | Y | Y | Y; But can this be more specific. |
| MO 4.2 | | | |
| RIN 4.1.1 | Y | Y | Y |
| RIN 4.1.2 | Y | Y | N; Important technical question not research question. |
| RIN 4.1.3 | Y | Y | Y |

General Comment: Objectives and Ins are specific and becoming by targeted to explicit needs. Some questions seem to be more general than necessary given the assumed knowledge base.

GOAL 5: MAINTAIN OR ATTAIN VIABLE POPULATIONS OF KANAB AMBERSNAIL

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|--|-------------------------|---|
| IN 5.1 | | | |
| IN 5.2 | Y | Y | Y; But is this not already known? |
| IN 5.3 | Y; If it is assumed that this information will be helpful in establishing a new population or enhancing existing population. | Y | Y |
| IN 5.4 | Y | Y | Y; Should be specified as technical question. |
| MO 5.1 | | | |
| CMIN 5.1.1 | Y | Y | Y |
| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |

| | | | |
|---------------|---|---|--|
| EIN 5.1.2 | Y | Y | Y; But this is already known, is it not? |
| RIN 5.1.3 | Y | Y | N; "Control population viability" is more appropriate. |
| RIN 5.1.4 | Y | Y | Y |
| MO 5.2 | | | |
| CMIN 5.2.1 | Y | Y | Y; Does "potential habitat" mean habitat that can be used i.e. accessible/useable. |
| RIN 5.1.4 | Y | Y | Y |
| MO 5.2 | | | |
| EIN 5.2.2 | Y | Y | Y; But this is known on Past '96 flow. |
| RIN 5.2.3 | Y | Y | Y; But isn't this already known? |
| RIN 5.2.4 | Y | Y | Y; But isn't this known from '96 flow? |
| RIN 5.2.5 | Y; If the age structure is changing or will change. | Y | Y |

General Comments: Should not "viable" and "target" population be the same. Many questions would appear to benefit from a scoping effort using existing science.

GOAL 6: PROTECT OR IMPROVE BIOTIC RIPARIAN AND SPRING COMMUNITIES.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|--------|--|---|---|
| IN 6.1 | Y | Y; If it is assumed the 84' levels represent baseline values. | Y |
| IN 6.2 | Y | Y | Y |
| IN 6.3 | Y | Y | Y; Technical question. |
| IN 6.4 | Y | Y | N; Should specify it as a need or eliminate it. |
| IN 6.5 | Y; This would allow efficient trend assessments. | Y | Y |
| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
| IN 6.6 | Y; This would allow efficient trend assessments. | Y | N; Specify as need or eliminate. |

MO 6.1

| | | | |
|------------|---|---|--|
| CMIN 6.1.1 | Y | Y | N; This should specify "5 year schedule <u>since Dam Construction</u> ". Better completed as research project. |
| RIN 6.1.1 | Y | Y | Y |
| RIN 6.1.2 | Y | Y | Y; Best done as research project (see 6.1.1). |
| RIN 6.1.3 | | | |

MO 6.2

| | | | |
|------------|--|---|--|
| CMIN 6.2.1 | Y; If it is assumed that the period post dam captures most variance and '84 values are the lowest possible. Are these assumptions correct? | Y | N; Should this not address historical range of variation and then range by variation post dam. |
| RIN 6.2.1 | Y | Y | N; Should this read post dam? |
| RIN 6.2.2 | Y | Y | Y |
| RIN 6.2 | Y | Y | N; "Change over long term". |

General Comment: This section is confusing regarding basis for selecting '84 baseline, and 5 year schedule.

MO 6.3

| | | | |
|------------|---|---|-------------------------------|
| CMIN 6.2.1 | Y | Y | N; Should this be "post dam"? |
| RIN 6.3.1 | Y | Y | N; Should this be "post dam"? |

IN Satisfies MO?

IN + MO satisfies Goal?

Appropriately Specified?

MO 6.4

| | | | |
|------------|---|---|-------------------------------|
| CMIN 6.4.1 | Y | Y | N; Should this be "post dam"? |
|------------|---|---|-------------------------------|

MO 6.5

| | | | |
|---------------|---|---|---|
| CMIN 6.5.1 | Y | Y | Y |
| RIN 6.5.1 | Y | Y | N; This should be specified as a monitoring IN. |
| MO 6.6 | | | |
| CMIN 6.6.1 | Y | Y | N; Should this be below NHWZ ? |
| CMIN 6.6.2 | Y | Y | Y |
| CMIN 6.6.3 | Y | Y | Y |
| RIN 6.6.1 | Y | Y | N. Specify as monitoring. |
| RIN 6.6.2 | Y | Y | Y |
| RIN 6.6.3 | Y | Y | Y |
| MO 6.7 | | | |
| CMIN 6.7.1 | Y | Y | Y |
| CMIN 6.7.2 | Y | Y | Y |
| CMIN 6.7.3 | Y | Y | Y |
| RIN 6.7.1 | Y | Y | Y |
| RIN 6.7.2 | Y | Y | Y |
| RIN 6.7.3 | Y | Y | Y; But could this be linked to drift assessments? |

GOAL 7: ESTABLISH WATER TEMPERATURE, QUALITY AND FLOW DYNAMICS TO ACHIEVE GCDAMP ECOSYSTEM GOALS.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|---|
| IN 7.1 | Y | Y | Y; Technical question |
| MO 7.1 | | | |
| CMIN 7.1.1 | Y | Y | Y |
| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
| CMIN 7.1.2 | Y | Y | N; This is needed but is a research/mgt question. |
| MO 7.2 | | | |
| CMIN 7.2.1 | Y | Y | N; Is needed but should relate to flow regimes as well as seasonal regimes. |

| | | | |
|-----------|---|---|---|
| RIN 7.2.1 | Y | Y | N; Should also specify "Lake Powell water quality". |
| RIN 7.2.2 | Y | Y | N; This is a monitoring question. |
| RIN 7.2.3 | Y | Y | Y |
| RIN 7.2.4 | Y | Y | Y |

General Comment: Lake Powell Goal and Objectives: Since almost the entire AMP program is predicated on operational approaches to Glen Canyon Dam, both Goals and Objectives should be specified. Although the listed Lake Powell INs seem sensible, they can only be effectively evaluated in reference to specified goals and objectives.

GOAL 8: MAINTAIN OR ATTAIN LEVELS OF SEDIMENT STORAGE WITHIN THE MAIN CHANNEL AND ALONG SHORELINES TO WHERE GCAMP ECOSYSTEM GOALS.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|--------------------------|
| IN 8.1 | Y | Y | Y; Technical question |
| MO 8.1 | | | |
| CMIN 8.1.2 | Y | Y | Y |
| CMIN 8.1.3 | Y | Y | Y |
| CMIN 8.1.4 | Y | Y | Y |
| CMIN 8.1.5 | Y | Y | Y |
| CMIN 8.1.6 | Y | Y | Y |
| CMIN 8.1.7 | Y | Y | Y |
| CMIN 8.1.8 | Y | Y | Y |
| RIN 8.1.1 | Y | Y | Y |
| RIN 8.1.2 | Y | Y | Y |
| MO 8.2 | | | |
| CMIN 8.2.1 | Y | Y | Y |
| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
| MO 8.3 | | | |
| CMIN 8.3.1 | Y | Y | Y |
| MO 8.4 | | | |
| CMIN 8.4.1 | Y | Y | Y |
| RIN 8.4.1 | Y | Y | Y |
| RIN 8.4.2 | Y | Y | Y |

| | | | |
|-----------|---|---|---|
| RIN 8.4.3 | Y | Y | Y |
| RIN 8.4.4 | Y | Y | Y |
| RIN 8.4.5 | Y | Y | Y |
| RIN 8.4.6 | Y | Y | Y |
| Rin 8.4.7 | Y | Y | Y |
| EIN 8.4.1 | Y | Y | Y |

General Comment: Unlike most INs, this Goal is structured with very specific INs. Seemingly, what is known has been documented and unknown parameters are pursued with highly specified INs. Obviously models are planned outcomes of the science process.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|-----------|------------------|-------------------------|---|
| SIN 8.4.1 | Y | Y | Y; But could be made more specific as regards vegetation. |
| SIN 8.4.2 | Y | Y | Y |
| SIN 8.4.3 | Y | Y | Y; This is needed, but don't we have this knowledge. |
| SIN 8.4.4 | Y | Y | Y; But could be more specific. Target primary productivity. |
| SIN 8.4.5 | Y | Y | Y |
| SIN 8.4.6 | Y | Y | Y; But this can be more specific i.e., 8.4.1 & 8.4.3. |
| SIN 8.4.7 | Y | Y | Y; Technical question. Well specified. |
| SIN 8.4.8 | Y | Y | Y |

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|------------|------------------|-------------------------|---|
| SIN 8.4.9 | Y | Y | Y; More specific. Some of this is known, i.e., five sediment deposition. |
| SIN 8.4.10 | Y | Y | Y; But if it were more specific to critical reaches it would be more helpful. |
| SIN 8.4.8 | Y | Y | Y |
| SIN 8.4.9 | Y | Y | Y |

GOAL 9: MAINTAIN OR IMPROVE THE QUALITY OF RECREATIONAL EXPERIENCES FOR USERS OF THE COLORADO RIVER ECOSYSTEM, WITHIN THE FRAME WORK OF GCDAMP ECOSYSTEM GOALS.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|--|-------------------------|---|
| IN 9.1 | Y | Y | Y; Technical question. |
| IN 9.2 | Y | Y | N; Specify as need or delete. |
| MO 9.1 | | | |
| CMIN 9.1.1 | Y | Y | N; "Efficient/and effective user access" is better. High and low flows allow access but is problematic. |
| CMIN 9.1.2 | Y | Y | N; Better specified by "accident rates at differing flows". |
| CMIN 9.1.4 | N; Comparisons to the Snake or Green seemingly adds nothing to Goal or MO. | N | N; Does not seem useful. |
| CMIN 9.1.5 | Y; Are injuries/deaths high? | Y | N; Not a monitoring IN. |

General Comment: Considerable emphasis is placed on accidents as detracting from the experience. Is this an assumption, or defined by science?

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|--|
| MO 9.2 | | | |
| CMIN 9.2.1 | Y | Y | N; This is not a monitoring need. It is a research need. |
| CMIN 9.2.2 | Y | Y | Y |
| CMIN 9.2.3 | Y | Y | N; This is best accomplished with research not monitoring. |
| CMIN 9.2.4 | Y | Y | Y; Could be accomplished with monitoring or research. |

| | | | |
|---------------|---|---|---|
| CMIN 9.2.5 | Y | Y | N; Best accomplished through research. |
| MO 9.3 | | | |
| CMIN 9.3.1 | Y | Y | Y |
| CMIN 9.3.2 | Y | Y | Y |
| CMIN 9.3.3 | Y | Y | Y |
| CMIN 9.3.4 | Y | Y | N; This is a research question. |
| CMIN 9.3.5 | Y | Y | N; This is a management/ research question. |

General Comment: This set of INs are poorly structured. Actually, the differing questions are confounding. Size is a quality parameter. If we do not know the parameters, how can we determine quality.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|---------------|------------------|-------------------------|---------------------------------|
| MO 9.4 | | | |
| CMIN 9.4.1 | Y | Y | Y |
| CMIN 9.4.2 | Y | Y | Y; But, Is this not a given? |
| MO 9.5 | | | |
| CMIN 9.5.1 | Y | Y | N; This is a research question. |
| CMIN 9.5.2 | Y | Y | N; This is a research question. |

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|------------|------------------|-------------------------|--|
| CMIN 9.5.3 | Y | Y | N; This is a management/policy question. |
| EIN 9.5.4 | Y | Y | Y. If a research question. |
| EIN 9.5.5 | N | N | N; EIN 9.5.4 answers EIN 9.5.5. |

GOAL 10: MAINTAIN POWER PRODUCTION CAPACITY AND ENERGY GENERATION, INCREASE WHERE FEASIBLE AND ADVISABLE, WITHIN THE FRAMEWORK OF GCDAM ECOSYSTEM GOALS.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|--|------------------|-------------------------|--------------------------|
|--|------------------|-------------------------|--------------------------|

MO 10.1

| | | | |
|------------|-------------------------|--------------------------------|---|
| RIN 10.1.1 | Y | Y | N; May be more feasible with monitoring or combined approach. |
| RIN 10.1.2 | Y | Y | N; Some resource impacts can be determined, but many can not. |
| RIN 10.1.3 | Y | Y | N; Some resource impacts can be determined, but many can not. |
| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
| RIN 10.1.4 | Y | Y | N; Some resource impacts can be determined, but many can not. |

General Comment: It is possible to evaluate these impacts with research flow regimes, however select evaluations might be best accomplished with monitoring over longer time periods. In every case, it might be best to use flow models, and GIS models of select alternatives to augment the research approach.

| | | | |
|-------------------|-------------------------|--------------------------------|---------------------------------|
| | IN Satisfied MO? | IN + MO satisfied Goal? | Appropriately Specified? |
| MO 10.2 | | | |
| No INs specified. | | | |
| MO 10.3 | | | |
| No INs specified. | | | |
| | IN Satisfies MO? | IN + MO Satisfies Goal? | Appropriately Specified? |
| MO 10.4 | | | |
| RIN 10.4.1 | Y | Y | Y |

GOAL 11: Preserve, protect, manage and treat cultural resources for the inspiration, and benefit of past, present and future generations.

| | | | |
|----------------|-------------------------|--------------------------------|----------------------------------|
| | IN Satisfies MO? | IN + MO Satisfies Goal? | Appropriately Specified? |
| MO 11.1 | | | |
| CMIN 11.1.1 | Y | Y | Y |
| CMIN 11.A | Y | Y | Y; 11.A Should be listed 11.1.2. |
| CMIN 11.1.2 | Y | Y | Y |

| | | | |
|--------------|---|---|---|
| CMIN 11.1.2A | Y | Y | Y; Should be listed as regular entries. |
| CMIN 11.1.2B | Y | Y | Y; Should be listed as regular entries. |
| CMIN 11.1.4 | Y | Y | Y |
| CMIN 11.1.5 | Y | Y | Y |
| CIM 11.1.5A | Y | Y | N; Technical/research question. |

General Comment: Although all questions appear valid to resolve the MO, there are problems with structure and specification. MO should be revisited to develop more focus and specificity.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|------------------|------------------|-------------------------|--|
| RIN 11.1.3 | Y | Y | N; Question should be reformulated to incorporate 11.1.3 A&B. |
| RIN 11.1.6 | N | N | N; Better posed as a management /policy question. |
| MO 11.2.1 | | | |
| CMIN 11.2.1 | Y | Y | N; Research question. |
| CMIN 11.2.2 | Y | Y | N; Research question |
| CMIN 11.2.3 | Y | Y | N; Some elements could be approached through monitoring. However, it is basically a a policy/management/research question. |
| CMIN 11.2.4 | Y | Y | N; Research/policy question. |
| CMIN 11.2.5 | Y | Y | Y; Could be approached with monitoring if above questions have been answered. |
| CMIN 11.2.6 | Y | Y | Y; If above knowledge exists. |

General Comment: All appear reasonable INs, but most cannot be pursued with monitoring.

MO 11.3

| | | | |
|------------|---|---|---|
| EIN 11.3.1 | Y | Y | Y |
| EIN 11.3.2 | Y | Y | Y |
| EIN 11.3.3 | Y | Y | Y |

General Comment: Two questions seem appropriate. Do AMP program activities impact access and how? What strategies can be implemented to mitigate impact?

GOAL 12: MAINTAIN A HIGH QUALITY MONITORING RESEARCH, AND ADAPTIVE MANAGEMENT PROGRAM!

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|----------------|------------------|-------------------------|--------------------------------------|
| IN 12.1 | Y | Y | Y; Technical question. |
| IN 12.2 | Y | Y | Y; Management/technical question. |
| MO 12.1 | | | |
| CMIN 12.1 | N | N | N |

General Comment: The MO & INs are too comprehensive and vague.

MO 12.2

| | | | |
|------------|---|---|---|
| EIN 12.2.1 | N | N | N |
|------------|---|---|---|

General Comment: The concept is important, but the question must be more specific to solicit effective research.

| | IN Satisfies MO? | IN + MO satisfies Goal? | Appropriately Specified? |
|----------------|------------------|-------------------------|--------------------------|
| MO 12.3 | | | |
| EIN 12.3.1 | N | N | N |
| EIN 12.3.2 | N | N | N |

General Comment: These questions are not focused. Make more specific or delete.

MO 12.5

| | | | |
|-------------|---|---|---|
| CMIN 12.5.1 | N | N | N |
| CMIN 12.5.2 | N | N | N |

General Comment: These MO and INs should not be pursued by GCMRC, but by the AMWG. They relate to appropriate stakeholder representation.

MO 12.7

| | | | |
|------------|---|---|--|
| RIN 12.7.1 | Y | Y | Y; A valuable question, but has broad overlap to questions in Goal 10. |
|------------|---|---|--|

General Comment on Goal 12: Science advisors are unsure of the general intent of this goal. However, it is not effective. In general, the goal could be eliminated with minimal impact to overall

program direction. However, some attempt appears to exist toward integration, which is needed. Possibly the goal could be redrafted with this in mind.